100 WINCHESTER SENIOR HOUSING PROJECT ENVIRONMENTAL NOISE ASSESSMENT SANTA CLARA, CALIFORNIA

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INTRODUCTION

The 100 Winchester Senior Housing project proposes the construction of 90 senior housing apartments at 100 Winchester Boulevard in Santa Clara, California. Currently, the site consists of a 59,000 square foot, 3-story office building, which would be demolished as part of this project. Primary access to the proposed apartment structure would be from Winchester Boulevard, located to the east of the project site. Along the southern and western boundaries of the project site are single-family residences. To the north is a Walgreens pharmacy, a multi-family apartment complex, and a building for the Pacific Autism Center for Education. Opposite Winchester Boulevard to the east of the project site, there are retail stores, a multi-family apartment complex, and medical offices.

This report evaluates the project's potential to result in significant impacts with respect to applicable CEQA guidelines. The report is divided into two sections: 1) the Setting Section provides a brief description of the fundamentals of environmental noise, summarizes applicable regulatory criteria, and discusses the results of the ambient noise monitoring survey completed to document existing noise conditions; and 2) the Impacts and Mitigation Measures Section describes the significance criteria used to evaluate project impacts, provides a discussion of each project impact, and presents mitigation measures, where necessary, to provide a compatible project in relation to adjacent noise sources and land uses.

SETTING

Fundamentals of Environmental Noise

Noise may be defined as unwanted sound. Noise is usually objectionable because it is disturbing or annoying. The objectionable nature of sound could be caused by its *pitch* or its *loudness*. *Pitch* is the height or depth of a tone or sound, depending on the relative rapidity (frequency) of the vibrations by which it is produced. Higher pitched signals sound louder to humans than sounds with a lower pitch. *Loudness* is intensity of sound waves combined with the reception characteristics of the ear. Intensity may be compared with the height of an ocean wave in that it is a measure of the amplitude of the sound wave.

In addition to the concepts of pitch and loudness, there are several noise measurement scales which are used to describe noise in a particular location. A *decibel (dB)* is a unit of measurement which indicates the relative amplitude of a sound. The zero on the decibel scale is based on the lowest sound level that the healthy, unimpaired human ear can detect. Sound levels in decibels are calculated on a logarithmic basis. An increase of 10 decibels represents a ten-fold increase in acoustic energy, while 20 decibels is 100 times more intense, 30 decibels is 1,000 times more intense, etc. There is a relationship between the subjective noisiness or loudness of a sound and its intensity. Each 10 decibel increase in sound level is perceived as approximately a doubling of loudness over a fairly wide range of intensities. Technical terms are defined in Table 1.

There are several methods of characterizing sound. The most common in California is the *A-weighted sound level (dBA).* This scale gives greater weight to the frequencies of sound to which the human ear is most sensitive. Representative outdoor and indoor noise levels in units of dBA are shown in Table 2. Because sound levels can vary markedly over a short period of time, a method for describing either the average character of the sound or the statistical behavior of the variations must be utilized. Most commonly, environmental sounds are described in terms of an average level that has the same acoustical energy as the summation of all the time-varying events. This *energy-equivalent sound/noise descriptor* is called L_{eq}. The most common averaging period is hourly, but L_{eq} can describe any series of noise events of arbitrary duration.

The scientific instrument used to measure noise is the *sound level meter*. Sound level meters can accurately measure environmental noise levels to within about plus or minus 1 dBA. Various computer models are used to predict environmental noise levels from sources, such as roadways and airports. The accuracy of the predicted models depends upon the distance the receptor is from the noise source. Close to the noise source, the models are accurate to within about plus or minus 1 to 2 dBA.

Since the sensitivity to noise increases during the evening and at night -- because excessive noise interferes with the ability to sleep -- 24-hour descriptors have been developed that incorporate artificial noise penalties added to quiet-time noise events. The *Community Noise Equivalent Level* (*CNEL*) is a measure of the cumulative noise exposure in a community, with a 5 dB penalty added to evening (7:00 p.m. - 10:00 p.m.) and a 10 dB addition to nocturnal (10:00 p.m. - 7:00 a.m.) noise levels. The *Day/Night Average Sound Level* (L_{dn}) is essentially the same as CNEL, with the exception that the evening time period is dropped and all occurrences during this three-hour period are grouped into the daytime period.

Fundamentals of Groundborne Vibration

Ground vibration consists of rapidly fluctuating motions or waves with an average motion of zero. Several different methods are typically used to quantify vibration amplitude. One method is the Peak Particle Velocity (PPV). The PPV is defined as the maximum instantaneous positive or negative peak of the vibration wave. In this report, a PPV descriptor with units of mm/sec or in/sec is used to evaluate construction generated vibration for building damage and human complaints. Table 3 displays the reactions of people and the effects on buildings that continuous vibration levels produce.

The annoyance levels shown in Table 3 should be interpreted with care since vibration may be found to be annoying at much lower levels than those shown, depending on the level of activity or the sensitivity of the individual. To sensitive individuals, vibrations approaching the threshold of perception can be annoying. Low-level vibrations frequently cause irritating secondary vibration, such as a slight rattling of windows, doors, or stacked dishes. The rattling sound can give rise to exaggerated vibration complaints, even though there is very little risk of actual structural damage.

Construction activities can cause vibration that varies in intensity depending on several factors. The use of pile driving and vibratory compaction equipment typically generates the highest construction related groundborne vibration levels. Because of the impulsive nature of such activities, the use of the PPV descriptor has been routinely used to measure and assess groundborne vibration and almost exclusively to assess the potential of vibration to induce structural damage and the degree of annoyance for humans.

The two primary concerns with construction-induced vibration, the potential to damage a structure and the potential to interfere with the enjoyment of life, are evaluated against different vibration limits. Studies have shown that the threshold of perception for average persons is in the range of 0.008 to 0.012 in/sec PPV. Human perception to vibration varies with the individual and is a function of physical setting and the type of vibration. Persons exposed to elevated ambient vibration levels, such as people in an urban environment, may tolerate a higher vibration level.

Structural damage can be classified as cosmetic only, such as minor cracking of building elements, or may threaten the integrity of the building. Safe vibration limits that can be applied to assess the potential for damaging a structure vary by researcher and there is no general consensus as to what amount of vibration may pose a threat for structural damage to the building. Construction-induced vibration that can be detrimental to the building is very rare and has only been observed in instances where the structure is at a high state of disrepair and the construction activity occurs immediately adjacent to the structure.

TABLE 1 Definition of Acoustical Terms Used in this Report

Term	Definition
Decibel, dB	A unit describing, the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure. The reference pressure for air is 20 micro Pascals.
Sound Pressure Level	Sound pressure is the sound force per unit area, usually expressed in micro Pascals (or 20 micro Newtons per square meter), where 1 Pascal is the pressure resulting from a force of 1 Newton exerted over an area of 1 square meter. The sound pressure level is expressed in decibels as 20 times the logarithm to the base 10 of the ratio between the pressures exerted by the sound to a reference sound pressure (e. g., 20 micro Pascals). Sound pressure level is the quantity that is directly measured by a sound level meter.
Frequency, Hz	The number of complete pressure fluctuations per second above and below atmospheric pressure. Normal human hearing is between 20 Hz and 20,000 Hz. Infrasonic sound are below 20 Hz and Ultrasonic sounds are above 20,000 Hz.
A-Weighted Sound Level, dBA	The sound pressure level in decibels as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise.
Equivalent Noise Level, L_{eq}	The average A-weighted noise level during the measurement period.
L_{max}, L_{min}	The maximum and minimum A-weighted noise level during the measurement period.
L_{01}, L_{10}, L_{50}, L_{90}	The A-weighted noise levels that are exceeded 1%, 10%, 50%, and 90% of the time during the measurement period.
Day/Night Noise Level, L_{dn} or DNL	The average A-weighted noise level during a 24-hour day, obtained after addition of 10 decibels to levels measured in the night between 10:00 p.m. and 7:00 a.m.
Community Noise Equivalent Level, CNEL	The average A-weighted noise level during a 24-hour day, obtained after addition of 5 decibels in the evening from 7:00 p.m.to 10:00 p.m. and after addition of 10 decibels to sound levels measured in the night between 10:00 p.m. and 7:00 a.m.
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.
Intrusive	That noise which intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, and time of occurrence and tonal or informational content as well as the prevailing ambient noise level.

Source: Handbook of Acoustical Measurements and Noise Control, Harris, 1998.

TABLE 2 Typical Noise Levels in the Environment

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
	110 dBA	Rock band
Jet fly-over at 1,000 feet		
	100 dBA	
Gas lawn mower at 3 feet		
	90 dBA	
Diesel truck at 50 feet at 50 mph		Food blender at 3 feet
	80 dBA	Garbage disposal at 3 feet
Noisy urban area, daytime		
Gas lawn mower, 100 feet	70 dBA	Vacuum cleaner at 10 feet
Commercial area		Normal speech at 3 feet
Heavy traffic at 300 feet	60 dBA	
		Large business office
Quiet urban daytime	50 dBA	Dishwasher in next room
Quiet urban nighttime	40 dBA	Theater, large conference room
Quiet suburban nighttime		
	30 dBA	Library
Quiet rural nighttime		Bedroom at night, concert hall (background)
	20 dBA	
		Broadcast/recording studio
	10 dBA	
	0 dBA	

Source: Technical Noise Supplement (TeNS), California Department of Transportation, September 2013.

TABLE 3 Reactions of People and Damage to Buildings from Continuous or Frequent Intermittent Vibration Levels

Velocity Level, PPV (in/sec)	Human Reaction	Effect on Buildings
0.01	Barely perceptible	No effect
0.04	Distinctly perceptible	Vibration unlikely to cause damage of any type to any structure
0.08	Distinctly perceptible to strongly perceptible	Recommended upper level of the vibration to which ruins and ancient monuments should be subjected
0.1	Strongly perceptible	Virtually no risk of damage to normal buildings
0.3	Strongly perceptible to severe	Threshold at which there is a risk of damage to older residential dwellings such as plastered walls or ceilings
0.5	Severe - Vibrations considered unpleasant	Threshold at which there is a risk of damage to newer residential structures

Source: Transportation and Construction Vibration Guidance Manual, California Department of Transportation, September 2013.

Regulatory Background - Noise

The State of California and the City of Santa Clara have established regulatory criteria that are applicable in this assessment. The State of California Environmental Quality Act (CEQA) Guidelines, Appendix G, are used to assess the potential significance of impacts pursuant to local General Plan policies, Municipal Code standards, or the applicable standards of other agencies. A summary of the applicable regulatory criteria is provided below.

State CEQA Guidelines. The CEQA contains guidelines to evaluate the significance of effects of environmental noise attributable to a proposed project. Under CEQA, noise impacts would be considered significant if the project would result in:

(a) Exposure of persons to or generation of noise levels in excess of standards established in the local General Plan or Noise Ordinance, or applicable standards of other agencies;

(b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels;

(c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project;

(d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project;

(e) For a project located within an airport land use plan or where such a plan has not been adopted within two miles of a public airport or public use airport, if the project would expose people residing or working in the project area to excessive noise levels; or

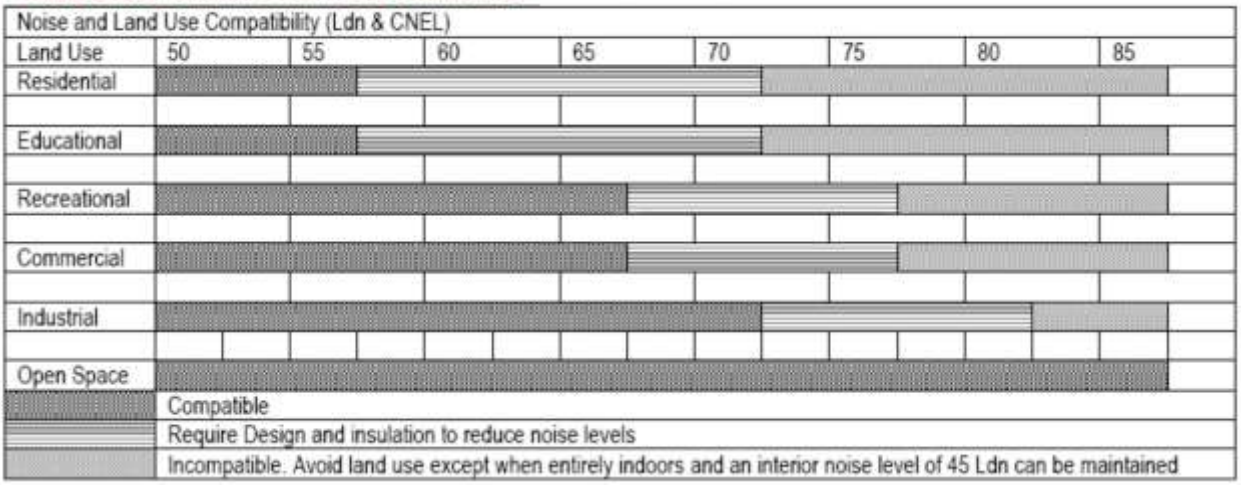
(f) For a project within the vicinity of a private airstrip, if the project would expose people residing or working in the project area to excessive noise levels.

CEQA does not define what noise level increase would be considered substantial. Typically, project-generated noise level increases of 3 dBA L_{dn}/CNEL or greater would be considered significant where exterior noise levels would exceed the normally acceptable noise level standard (60 dBA L_{dn}/CNEL for residential land uses). Where noise levels would remain at or below the normally acceptable noise level standard with the project, noise level increases of 5 dBA L_{dn}/CNEL or greater would be considered significant.

2010 California Building Code. The State of California established exterior sound transmission control standards for new hotels, motels, dormitories, apartment houses, and dwellings other than detached single-family dwellings as set forth in the 2010 California Building Code (Chapter 12, Section 1207.11). Interior noise levels attributable to exterior environmental noise sources shall not exceed 45 dBA L_{dn}/CNEL in any habitable room. When exterior noise levels (the higher of existing or future) where residential structures are to be located exceed 60 dBA L_{dn}/CNEL, a report must be submitted with the building plans describing the noise control measures that have been incorporated into the design of the project to meet the noise limit. The 2013 California Building Code did not include the interior noise level threshold of 45 dBA L_{dn}/CNEL; however, the Initial Statement of Reasons for the change stated that the Department of Housing and Community Development (HCD) proposes to adopt a new section requiring interior noise levels attributable to exterior sources not to exceed 45 dB in any habitable room. Therefore, the interior noise threshold established in the 2010 California Building Code should still be applied to new buildings.

City of Santa Clara General Plan. The City of Santa Clara's General Plan identifies noise and land use compatibility standards for various land uses and establishes policies to control noise within the community. Table 5.10-2 from the General Plan shows acceptable levels for various land uses. Residential land uses are considered compatible in noise environments of 55 dBA L_{dn}/CNEL or less. The guidelines state that where the exterior noise levels are greater than 55 dBA L_{dn}/CNEL and less than 70 dBA L_{dn}/CNEL, the design of the project should include measures to reduce noise levels to acceptability. Noise levels exceeding 70 dBA L_{dn}/CNEL are considered incompatible. Residential land uses proposed in noise environments exceeding 70 dBA L_{dn}/CNEL should generally be avoided, except when the residential use is entirely indoors where interior noise levels can be maintained at 45 dBA L_{dn}/CNEL or less.

TABLE 5.10-2: GENERAL PLAN NOISE STANDARDS



Applicable goals and policies presented in the General Plan are as follows:

5.10.6-G1 Noise sources restricted to minimize impacts in the community.

5.10.6-G2 Sensitive uses protected from noise intrusion.

5.10.6-G3 Land use, development and design approvals that take noise levels into consideration.

5.10.6-P1 Review all land use and development proposals for consistency with the General Plan compatibility standards and acceptable noise exposure levels defined on Table 5.10-1.

5.10.6-P2 Incorporate noise attenuation measures for all projects that have noise exposure levels greater than General Plan "normally acceptable" levels, as defined on Table 5.10-1.

5.10.6-P3 New development should include noise control techniques to reduce noise to acceptable levels, including site layout (setbacks, separation and shielding), building treatments (mechanical ventilation system, sound-rated windows, solid core doors and baffling) and structural measures (earthen berms and sound walls).

5.10.6-P4 Encourage the control of noise at the source through site design, building design, landscaping, hours of operation and other techniques.

5.10.6-P5 Require noise-generating uses near residential neighborhoods to include solid walls and heavy landscaping along common property lines, and to place compressors and mechanical equipment in sound-proof enclosures.

5.10.6-P6 Discourage noise sensitive uses, such as residences, hospitals, schools, libraries, and rest homes, from areas with high noise levels, and discourage high noise generating uses from areas adjacent to sensitive uses.

5.10.6-P7 Implement measures to reduce interior noise levels and restrict outdoor activities in areas subject to aircraft noise in order to make Office/Research and Development uses compatible with the Norman Y. Mineta International Airport land use restrictions.

City of Santa Clara Municipal Code. The City's Municipal Code establishes noise level performance standards for fixed sources of noise. Section 9.10.40 of the Municipal Code limits noise levels at multi-family residences to 55 dBA during daytime hours (7:00 a.m. to 10:00 p.m.) and 50 dBA at night (10:00 p.m. to 7:00 a.m.). The noise limits are not applicable to emergency work, licensed outdoor events, City-owned electric, water, and sewer utility system facilities, construction activities occurring within allowable hours, permitted fireworks displays, or permitted heliports. Construction activities are not permitted within 300 feet of residentially zoned property except within the hours of 7:00 a.m. and 6:00 p.m. on weekdays and 9:00 a.m. and 6:00 p.m. on Saturdays. No construction is permitted on Sundays or holidays.

The City Code does not define the acoustical time descriptor such as L_{eq} (the average noise level) or L_{max} (the maximum instantaneous noise level) that is associated with the above limits. A reasonable interpretation of the City Code would identify the ambient base noise level criteria as an average or median noise level (L_{eq}/L_{50}).

Existing Noise Environment

The project site is located at 100 Winchester Boulevard in the City of Santa Clara. The surrounding land uses include single-family residences to the south and west. Along the northern boundary of the project site, there is a Walgreens pharmacy, a multi-family apartment complex, and a building for the Pacific Autism Center for Education. Opposite Winchester Boulevard to the east of the project site, there are retail stores, a multi-family apartment complex, and medical offices. A noise monitoring survey was performed at the site beginning on Tuesday March 17, 2015 and concluding on Friday March 20, 2015. The monitoring survey included one long-term and two short-term noise measurements, as shown in Figure 1. The noise environment at the site and in the surrounding areas results primarily from vehicular traffic along Winchester Boulevard, as well as neighborhood traffic along Jill Avenue and Fernwood Avenue and parking lot traffic. Occasional overhead aircraft associated with the Mineta San José International Airport would also potentially affect the noise environment at the project site.

Long-term noise measurement, LT, was made in the southeast corner of the project site, approximately 50 feet from the centerline of Winchester Boulevard. LT was placed in a tree near the boundary of the project site and the backyard of a single-family residence. Hourly average noise levels at this location typically ranged from 65 to 72 dBA L_{eq} during the day, and from 54 to 68 dBA L_{eq} at night. The average community noise equivalent level noise level from Tuesday

March 17, 2015 through Friday March 20, 2015 was 71 dBA CNEL. The daily trend in noise levels at LT is shown in Figure 2.

Short-term noise measurements, ST-1 and ST-2, were conducted on Tuesday March 20, 2015 in ten-minute intervals starting at 11:30 a.m. The ST-1 measurement was made near at the rear of the parking lot along the western boundary of the project site. ST-1 was approximately 140 feet west of the existing office building and approximately 160 feet east of the centerline of Jill Avenue. The ten-minute $L_{eq(10)}$ measured at ST-1 was 46 dBA $L_{eq(10)}$, and the estimated average community noise equivalent level was 48 dBA CNEL. ST-2 was made closer to the existing office building in the parking lot along the southern boundary of the project site. ST-2 was approximately 30 feet west of the existing office building and approximately 390 feet west of the centerline of Winchester Boulevard. The ten-minute $L_{eq(10)}$ measured at ST-2 was 50 dBA $L_{eq(10)}$, and the estimated average community noise equivalent level was 52 dBA CNEL. Table 4 summarizes the results for all of the short-term measurements.

FIGURE 1 Noise Measurement Locations

FIGURE 2 Noise Levels at LT, Located in the Southeast Corner 100 Winchester Boulevard, ~50 feet from the Centerline of Winchester Boulevard, from March 17 through March 20, 2015

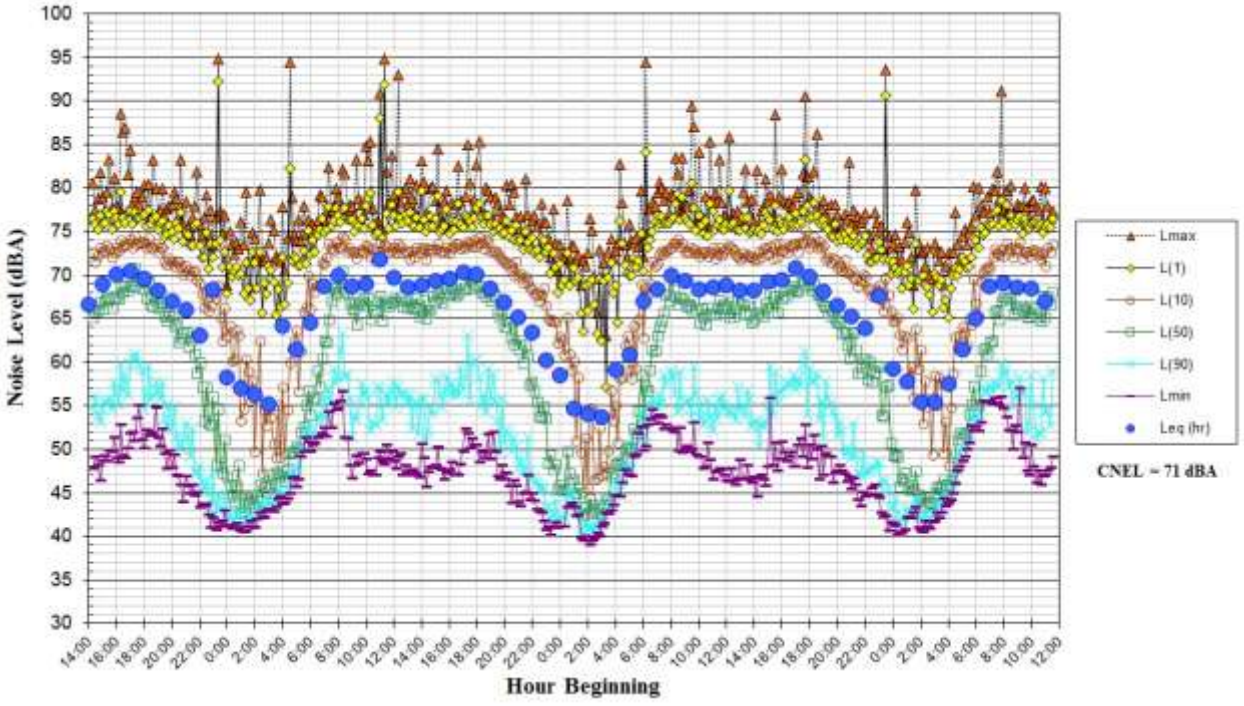


TABLE 4 Summary of Short-Term Noise Measurements (dBA)

Noise Measurement Location (Date, Time)	L_{min}	L_{max}	$L_{(1)}$	$L_{(10)}$	$L_{(50)}$	$L_{(90)}$	$L_{eq(10)}$	CNEL
ST-1: Rear of parking lot along western boundary of property (3/20/2015, 11:30-11:40)	41	56	53	48	45	43	46	48
ST-2: Edge of parking lot along southern boundary of the property (3/20/2015, 11:30-11:40)	40	62	58	53	48	44	50	52

NOISE IMPACTS AND MITIGATION MEASURES

Significance Criteria

Paraphrasing from Appendix G of the CEQA Guidelines, a project would normally result in significant noise impacts if noise levels generated by the project conflict with adopted environmental standards or plans, if the project would generate excessive ground-borne vibration levels, or if ambient noise levels at sensitive receivers would be substantially increased over a permanent, temporary, or periodic basis. The following criteria were used to evaluate the significance of environmental noise resulting from the project:

- A significant noise impact would be identified if the project would expose persons to or generate noise levels that would exceed applicable noise standards presented in the General Plan, Specific Plan, or Code of Ordinances.

- A significant impact would be identified if the construction of the project would expose persons to excessive vibration levels. Groundborne vibration levels exceeding 0.3 in/sec PPV would have the potential to result in cosmetic damage to normal buildings.

- A significant impact would be identified if traffic generated by the project would substantially increase noise levels at sensitive receivers in the vicinity. A substantial increase would occur if: a) the noise level increase is 5 dBA CNEL or greater, with a future noise level of less than 60 dBA CNEL, or b) the noise level increase is 3 dBA CNEL or greater, with a future noise level of 60 dBA CNEL or greater.

- A significant noise impact would be identified if construction-related noise would temporarily increase ambient noise levels at sensitive receptors. Hourly average noise levels exceeding 60 dBA $L_{eq,}$ and the ambient by at least 5 dBA L_{eq}, for a period of more than one year would constitute a significant temporary noise increase at adjacent residential land uses.

Impact 1: **Noise and Land Use Compatibility.** Future noise levels on the edge of the roof terrace would potentially exceed the 55 dBA CNEL exterior noise and land use compatibility standard for residential land uses as presented in the City of Santa Clara General Plan. Interior noise levels would be expected to exceed 45 dBA CNEL at the units adjacent to Winchester Boulevard assuming standard residential construction methods. **This is a significant impact.**

Future Exterior Noise Environment

The future noise environment at the project site would continue to be dominated by traffic along Winchester Boulevard. The proposed project is not expected to increase traffic volumes along Winchester Boulevard or any of the local surrounding roadways, as there would be a new reduction in trips due to the change in land use from office to residential. Access to the project

site under the proposed project conditions is expected to decrease peak hour and daily trip generation from existing conditions. Therefore, environmental noise in the project vicinity is not expected to increase from existing conditions.

The proposed senior apartment complex would have two outdoor garden court areas and a pool area that would be considered public use. Both of the garden courts would be completely surrounded by the apartment structures, and therefore, would be shielded from traffic noise along Winchester Boulevard. The pool area would be located between the two building structures, receiving shielding from the Winchester Boulevard traffic by the easternmost building. Due to the shielding provided by the apartment structures, the future noise levels would be less than 55 dBA CNEL. This would be a less-than-significant impact.

An outdoor roof terrace located immediately adjacent to Winchester Boulevard would also be an outdoor use area for the proposed project. The setback of the roof terrace from the centerline of the roadway would be approximately 70 feet, and the height of the terrace from the ground would be approximately 35 feet. Within five feet of the edge of the roof terrace, residents would potentially have direct line-of-sight to the vehicles below along Winchester Boulevard. At this distance, the future exterior noise levels would be as high as 60 dBA CNEL. According to the elevation plan for the proposed building, there would be a small barrier lining the terrace. Assuming this barrier is solid, the future noise levels at distances greater than five feet from the edge of the terrace would be below 55 dBA CNEL. While each of the apartment units facing the exterior of the building would have a balcony area, these are not considered public use, and the exterior noise standards do not normally apply.

Noise levels in outdoor use areas that are affected by transportation noise are required to be maintained at or below 55 dBA CNEL to be considered compatible for residential land uses, according to the City's General Plan. Noise levels greater than 55 dBA CNEL and less than 70 dBA CNEL would require design to reduce noise levels to acceptability. Exterior levels exceeding 70 dBA CNEL would be considered incompatible. Both outdoor garden courts and the pool area for the proposed project are within the interior of the site and would have exterior noise levels less than 55 dBA CNEL. While future exterior noise levels at the edge of the roof terrace would potentially exceed 55 dBA CNEL, at distances greater than five feet, the noise levels would be below 55 dBA CNEL.

Future Interior Noise Environment

The City of Santa Clara requires that interior noise levels should be maintained at 45 dBA CNEL or less for residential units. The residential units of the proposed senior apartment complex adjacent to Winchester Boulevard would be exposed to exterior noise levels of approximately 70 dBA CNEL. The units along the northern and southern sides of the apartment structures would be exposed to exterior noise levels ranging from below 55 to 70 dBA CNEL, and the units at the rear of the project site would be exposed to levels below 55 dBA CNEL.

Interior noise levels would vary depending upon the design of the buildings (relative window area to wall area) and the selected construction materials and methods. Standard residential construction provides approximately 15 dBA of exterior to interior noise reduction, assuming the windows are partially open for ventilation. Standard construction with the windows closed provides approximately 20 to 25 dBA of noise reduction in interior spaces. Where exterior noise levels range from 60 to 65 dBA CNEL, the inclusion of adequate forced air mechanical ventilation is often the method selected to reduce interior noise levels to acceptable levels by closing the windows to control noise. Where noise levels exceed 65 dBA CNEL, forced-air mechanical ventilation systems and sound-rated construction methods are normally required. Such methods or materials may include a combination of smaller window and door sizes as a percentage of the total building façade facing the noise source, sound-rated windows and doors, sound rated exterior wall assemblies, and mechanical ventilation so windows may be kept closed at the occupant's discretion.

Mitigation Measure 1:

The following mitigation measures shall be incorporated into the proposed project to reduce exterior noise levels at the roof terrace:

- Mitigation methods available to reduce exterior noise levels in outdoor use areas include site planning alternatives (e.g., increased setbacks and using the proposed buildings as noise barriers), the construction of traditional noise barriers, or a combination of the above. For the proposed project, one alternative would be to move the location of the roof terrace farther from Winchester Boulevard. If, for example, the roof terrace was located on the building façade facing one of the garden courts or the pool area on the interior of the site, the increased setback from the roadway, as well as shielding from proposed structures, would reduce future exterior noise levels throughout the roof terrace to below 55 dBA CNEL.

- The proposed barrier shown in the elevation plan should be located around the perimeter of the roof terrace, attaching to the proposed building on both sides. This would provide shielding from traffic along Winchester Boulevard at distance of five feet or greater from the edge of the terrace. The total length of the proposed barrier would be approximately 185 feet. The proposed barrier would be continuous from floor to top, with no cracks or gaps, and have a minimum surface density of three lbs/ft^2 (e.g., one-inch thick marine-grade plywood, ½-inch laminated glass, concrete masonry units (CMU), stucco). To reduce levels near the edge of the terrace, the barrier would need to be at least five to six feet in height. Below this height, noise levels would meet the threshold at distances beyond five feet from the edge, but residents at the edge would be exposed to levels exceeding the threshold.

The following mitigation measures shall be incorporated into the proposed project to reduce interior noise levels:

- A qualified acoustical consultant shall review the final site plan, building elevations, and floor plans prior to construction to calculate expected interior noise levels on a unit-by-unit basis. Project-specific acoustical analyses are required to confirm that the design results in interior noise levels reduced to 45 dBA CNEL or lower for the first through fourth floors. While adjacent buildings and residences along the northern and southern sides of the proposed senior apartment complex would provide partial shielding from the traffic noise along Winchester Boulevard for the first and second floors, they may not be adequate to reduce levels on the third and fourth floors. Units along Winchester Boulevard, as well as exterior-facing units along the northern and southern sides of the complex, would require analysis for potential sound-rated construction methods and building facade treatments to maintain interior noise levels at or below acceptable levels. These treatments would include, but are not limited to, sound rated windows and doors, sound rated wall constructions, acoustical caulking, protected ventilation openings, etc. From the building floor plans and elevations provided at the time of this analysis, the units with direct line-of-sight to Winchester Boulevard would require windows and doors with a minimum Sound Transmission Class (STC)[1] rating of 26 to 31. The specific determination of what noise insulation treatments are necessary shall be conducted on a unit-by-unit basis during final design of the project. Results of the analysis, including the description of the necessary noise control treatments, shall be submitted to the City, along with the building plans and approved design, prior to issuance of a building permit.

- Building sound insulation requirements would need to include the provision of forced-air mechanical ventilation for all perimeter apartment units within 250 feet of Winchester Boulevard, so that windows could be kept closed at the occupant's discretion to control noise.

The implementation of these mitigation measures would reduce the impact to a less-than-significant level.

Impact 2: **Exposure to Excessive Groundborne Vibration.** Construction-related vibration would not be excessive at nearby residential land uses. **This is a less-than-significant impact.**

The construction of the project may generate perceptible vibration when heavy equipment or impact tools (e.g. jackhammers, hoe rams) are used. Construction activities would include site demolition, preparation work, foundation work, and new building framing and finishing. The proposed project would not require pile driving, which can cause excessive vibration.

For structural damage, the California Department of Transportation recommends a vibration limit of 0.5 in/sec PPV for buildings structurally sound and designed to modern engineering

[1] **Sound Transmission Class (STC)** A single figure rating designed to give an estimate of the sound insulation properties of a partition. Numerically, STC represents the number of decibels of speech sound reduction from one side of the partition to the other. The STC is intended for use when speech and office noise constitute the principal noise problem.

standards, 0.3 in/sec PPV for buildings that are found to be structurally sound but where structural damage is a major concern, and a conservative limit of 0.08 in/sec PPV for ancient buildings or buildings that are documented to be structurally weakened. No ancient buildings or buildings that are documented to be structurally weakened adjoin the project site. Therefore, groundborne vibration levels exceeding 0.3 in/sec PPV would have the potential to result in a significant vibration impact.

Table 5 presents typical vibration levels that could be expected from construction equipment at a distance of 25 feet. Project construction activities, such as drilling, the use of jackhammers, rock drills and other high-power or vibratory tools, and rolling stock equipment (tracked vehicles, compactors, etc.) may generate substantial vibration in the immediate vicinity. Jackhammers typically generate vibration levels of 0.035 in/sec PPV, and drilling typically generates vibration levels of 0.09 in/sec PPV at a distance of 25 feet. Vibration levels would vary depending on soil conditions, construction methods, and equipment used. The adjacent single-family residences range from 20 to 64 feet from the project site; at these distances, vibration levels would be expected to be 0.27 in/sec PPV or less, below the 0.3 in/sec PPV significance threshold. Vibration generated by construction activities near the common property line would at times be perceptible, however, would not be expected to result in "architectural" damage to these buildings. This is a less-than-significant impact.

TABLE 5 Vibration Source Levels for Construction Equipment

Equipment		**PPV at 25 ft. (in/sec)**	**Approximate L_v at 25 ft. (VdB)**
Pile Driver (Impact)	upper range	1.158	112
	typical	0.644	104
Pile Driver (Sonic)	upper range	0.734	105
	typical	0.170	93
Clam shovel drop		0.202	94
Hydromill (slurry wall)	in soil	0.008	66
	in rock	0.017	75
Vibratory Roller		0.210	94
Hoe Ram		0.089	87
Large bulldozer		0.089	87
Caisson drilling		0.089	87
Loaded trucks		0.076	86
Jackhammer		0.035	79
Small bulldozer		0.003	58

Source: Transit Noise and Vibration Impact Assessment, United States Department of Transportation, Office of Planning and Environment, Federal Transit Administration, May 2006.

Mitigation Measure 2: None required.

Impact 3: Project-Generated Traffic Noise. The proposed project would not result in a permanent noise level increase at the existing residential land uses in the project vicinity. **This is a less-than-significant impact.**

Traffic along Winchester Boulevard dominates the noise environment in the area. Additionally, the local traffic along Fernwood Avenue and Jill Avenue would also affect the noise environment at the surrounding single-family residences. The proposed project would not have a measurable effect on the traffic along these roads. The only traffic change, in fact, would be the trip generations on the project site. At peak hours, access to the proposed project site would decrease by approximately 74 vehicles in the morning and 65 vehicles in the evening. This decrease in trip generation would not cause a permanent noise level increase at the surrounding noise-sensitive receptors. This is a less-than-significant impact.

Mitigation Measure 3: **None required.**

Impact 4: **Project-Generated Mechanical Noise.** The proposed project could generate noise in excess of the City's exterior noise guidelines for fixed sources of noise. The proposed project would, therefore, potentially expose noise-sensitive receptors to and generate noise levels in excess of the City's established guidelines. **This is a potentially significant impact.**

The proposed project would include mechanical equipment, such as heating, ventilation, and air conditioning systems. Under the City of Santa Clara Municipal Code, noise generated by fixed sources of noise would be restricted to 55 dBA during daytime hours (7:00 a.m. to 10:00 p.m.) and to 50 dBA during nighttime hours (10:00 p.m. to 7:00 a.m.) at multi-family residences. Information regarding the number, type, and size of the mechanical equipment units to be used in the proposed project was not available at the time of this study. The placement of such equipment on or surrounding the proposed apartment complex had also not been established. Without this information, calculations cannot be made regarding noise levels at nearby sensitive receptors. Noise from mechanical equipment was therefore conservatively identified as a potentially significant impact.

Mitigation Measure 4:

Due to the number of variables inherent in the mechanical equipment needs of the project (number and type of units, locations, size, housing or enclosures, etc.), the impacts of mechanical equipment noise on nearby noise-sensitive uses shall be assessed during the final stage of project design. Design planning shall take into account the noise criteria associated with such equipment and use site planning to locate equipment in less noise-sensitive areas, where feasible. Other controls could include, but shall not be limited to, fan silencers, enclosures, and screen walls.

An acoustical study shall be prepared during final project design to evaluate the potential noise generated by building mechanical equipment and to identify the necessary noise controls that are included in the design to meet the City's 55 dBA daytime and 50 dBA nighttime noise limits. The study shall be submitted to the City of Santa Clara for review and approval prior to issuance of any building permits. Implementation of these mitigation measures would reduce this impact to a less-than-significant level.

Impact 5: **Temporary Construction Noise.** Existing noise-sensitive land uses would not be exposed to construction noise levels in excess of the significance thresholds for a period of more than one year. **This is a less-than-significant impact**.

Noise impacts resulting from construction depend upon the noise generated by various pieces of construction equipment, the timing and duration of noise-generating activities, and the distance between construction noise sources and noise-sensitive areas. Construction noise impacts primarily result when construction activities occur during noise-sensitive times of the day (e.g., early morning, evening, or nighttime hours), the construction occurs in areas immediately adjoining noise-sensitive land uses, or when construction lasts over extended periods of time. Where noise from construction activities exceeds 60 dBA L_{eq} and exceeds the ambient noise environment by at least 5 dBA L_{eq} at noise-sensitive uses in the project vicinity for a period exceeding one year, the impact would be considered significant.

Construction activities generate considerable amounts of noise, especially during earth-moving activities when heavy equipment is used. The highest maximum noise levels generated by project construction would typically range from about 90 to 95 dBA L_{max} at a distance of 50 feet from the noise source. Typical hourly average construction-generated noise levels are about 81 to 88 dBA L_{eq} measured at a distance of 50 feet from the center of the site during busy construction periods (e.g., earth moving equipment, impact tools, etc.). Construction-generated noise levels drop off at a rate of about 6 dBA per doubling of the distance between the source and receptor. Shielding by buildings or terrain often result in lower construction noise levels at distant receptors.

Approximately 12 months would be required to complete the construction portion of the proposed project. Construction activities would include demolition, site preparation, excavation, grading, trenching, building construction, paving, and architectural coating. Once construction moves indoors, minimal noise would be generated at off-site locations. Noise generated by construction activities would temporarily elevate noise levels at adjacent noise-sensitive receptors, but this would be considered a less-than-significant impact, assuming that construction activities are conducted in accordance with the implementation of construction best management practices.

The following standard controls are assumed to be included in the project:

- The City's Municipal Code limits construction activities within 300 feet of residentially zoned property to the hours between 7:00 a.m. and 6:00 p.m., Monday through Friday, and between the hours of 9:00 a.m. and 6:00 p.m. on Saturdays. No construction is permitted on Sundays or holidays.

- Equip all internal combustion engine-driven equipment with intake and exhaust mufflers that are in good condition and appropriate for the equipment.

- Unnecessary idling of internal combustion engines should be strictly prohibited.

- Locate stationary noise-generating equipment such as air compressors or portable power generators as far as possible from sensitive receptors. Construct temporary noise barriers to screen stationary noise-generating equipment when located near adjoining sensitive land uses. Temporary noise barriers could reduce construction noise levels by 5 dBA.

- Utilize "quiet" air compressors and other stationary noise sources where technology exists.

- Control noise from construction workers' radios to a point where they are not audible at existing residences bordering the project site.

- The contractor shall prepare a detailed construction plan identifying the schedule for major noise-generating construction activities. The construction plan shall identify a procedure for coordination with adjacent residential land uses so that construction activities can be scheduled to minimize noise disturbance.

- Designate a "disturbance coordinator" who would be responsible for responding to any complaints about construction noise. The disturbance coordinator will determine the cause of the noise complaint (e.g., bad muffler, etc.) and will require that reasonable measures be implemented to correct the problem. Conspicuously post a telephone number for the disturbance coordinator at the construction site and include in it the notice sent to neighbors regarding the construction schedule.

Implementation of the above measures would reduce construction noise levels emanating from the site, limit construction hours, and minimize disruption and annoyance. With the implementation of these measures, and recognizing that noise generated by construction activities would occur over a temporary period, the temporary increase in ambient noise levels would be less-than-significant.

Mitigation Measure 5: None required.

Impact 6: Noise and Land Use Compatibility (Aircraft). The proposed project would be located in a compatible noise environment with respect to noise generated by Mineta San José International Airport. **This is a less-than-significant impact**.

Mineta San José International Airport is a public-use airport located approximately 1.8 miles northeast of the project site. Although aircraft-related noise could occasionally be audible at the project site, noise from aircraft would not substantially increase ambient noise levels. The project site lies outside the 2017 and 2027 noise contours shown in the Norman Y. Mineta San José International Airport Master Plan Update Project report published in February 2010 as a addendum to the Environmental Impact Report. Exterior and interior noise levels resulting from aircraft would be compatible with the proposed project. This is a less-than-significant impact.

Mitigation Measure 6: None Required.